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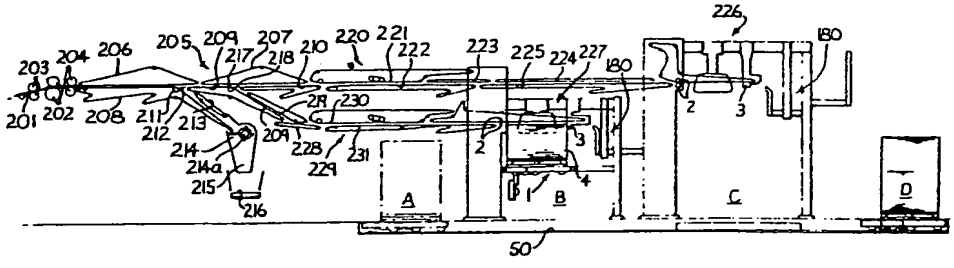
(54) Sheet handling apparatus

(57) A machine for cutting sheets of paper and forming them into stacks has two stacking devices (226, 227) which alternately form stacks. Each of the stacking devices includes a platform (1) which descends as a stack being formed on it grows higher, and is so constructed that its length can be varied according to the length of sheets to be stacked. The platform is made in two or more sections each hinged to the next, and all sections are supported horizontally to receive long sheets; less than all the sections being horizontal and the remaining sections hanging vertically when shorter sheets are being stacked. Wheels may be provided on the platform so that it may easily be moved out of the stacking device when loaded, all the sections being restored to a horizontal position for such movement.

The machine is also provided with a cutter (214, 214a) which cuts rejected sheets into narrow strips which are then conveyed away from the machine by a conveyor (216). Alternatively the sheets may be slit longitudinally into strips.

Fig. 1



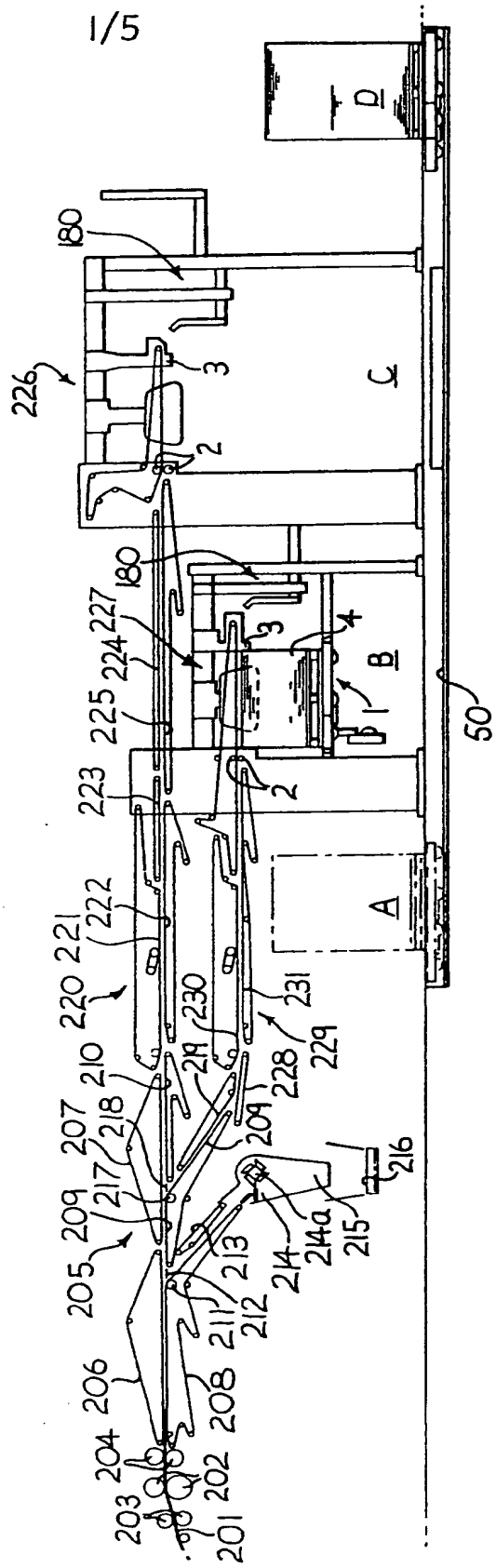


FIG. 1

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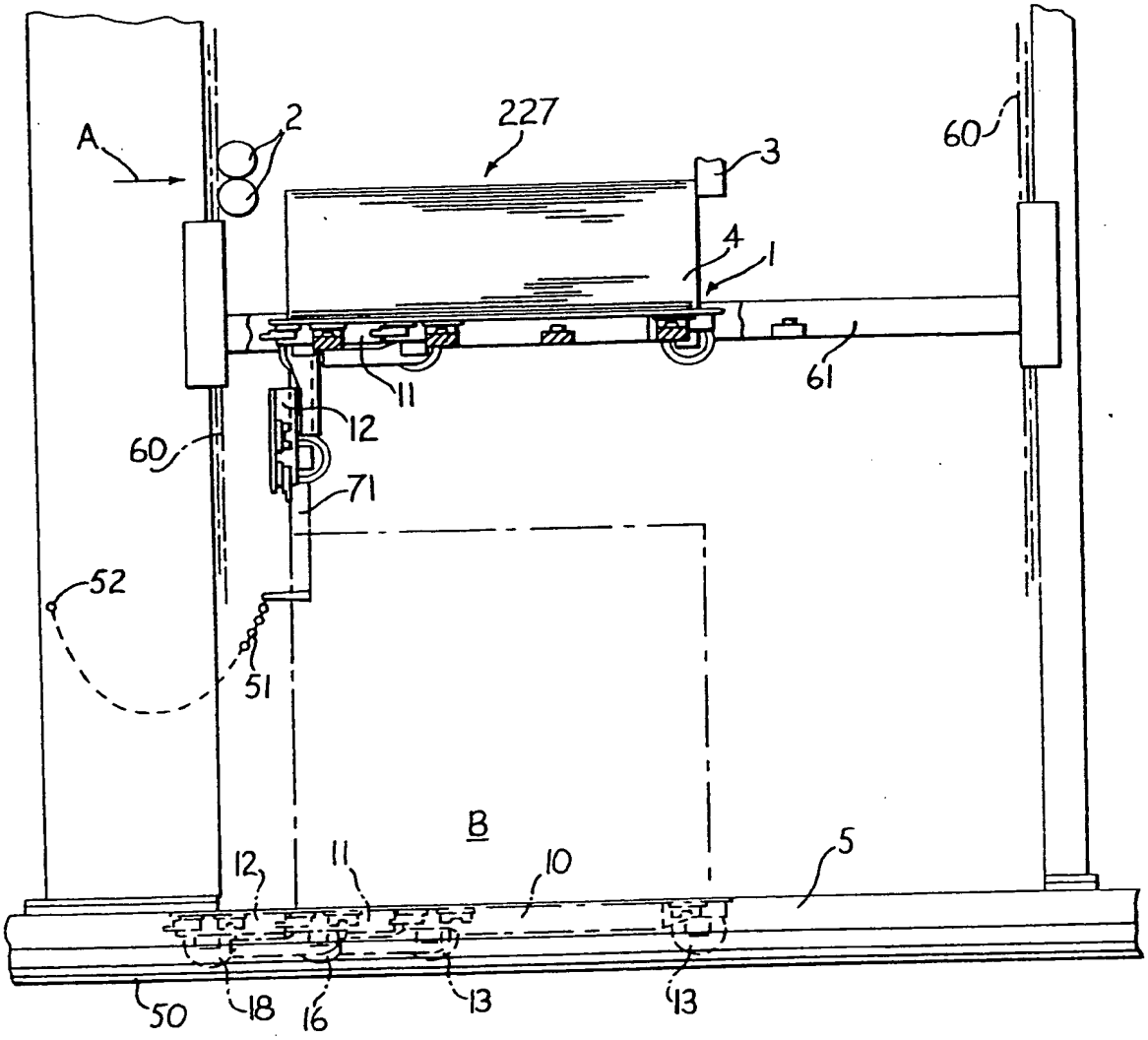
FIG. 2



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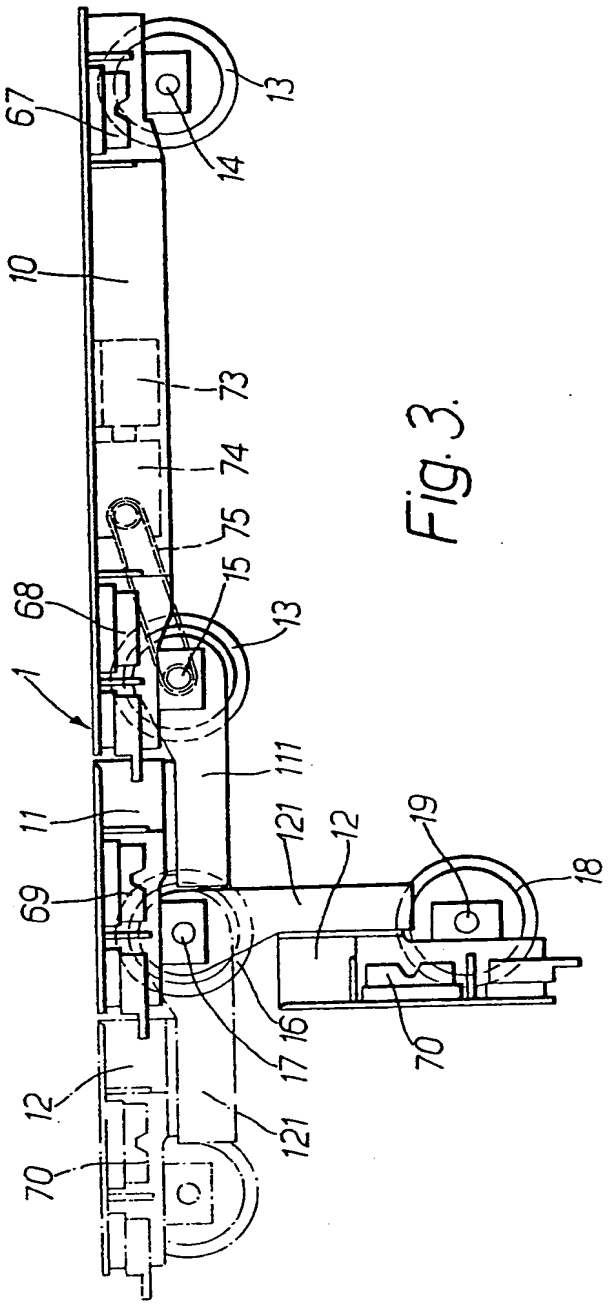

Fig. 3.

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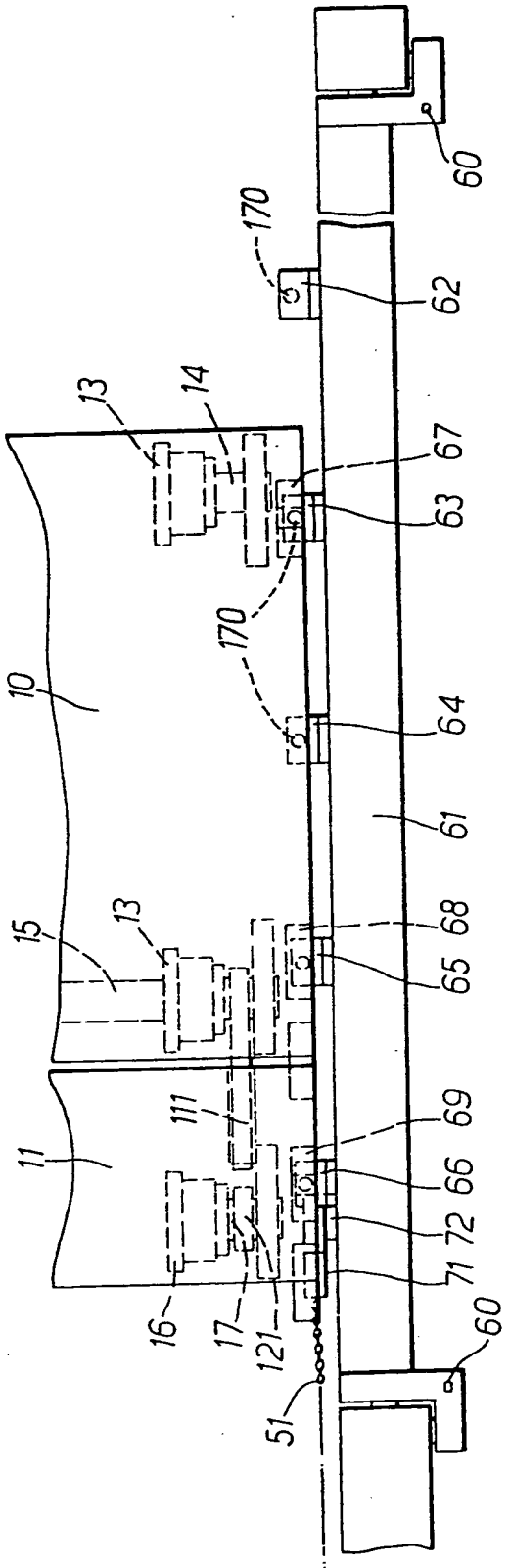

Fig. 4.

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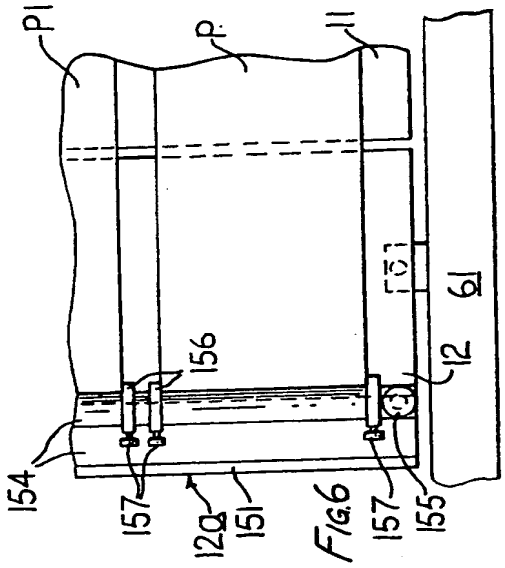

Fig.6

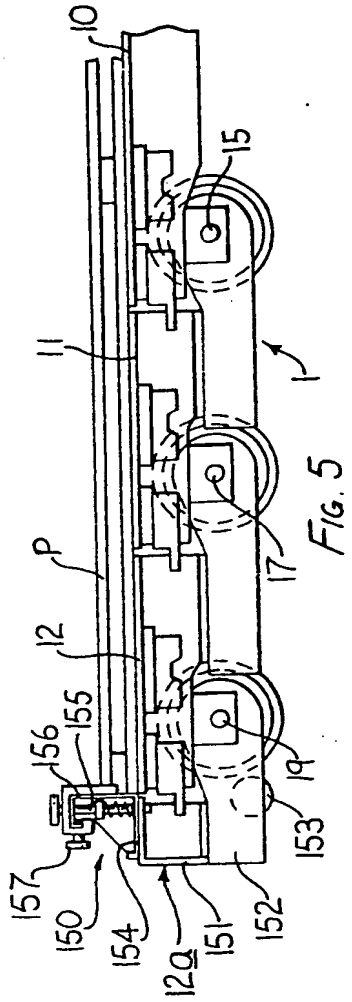

Fig. 5

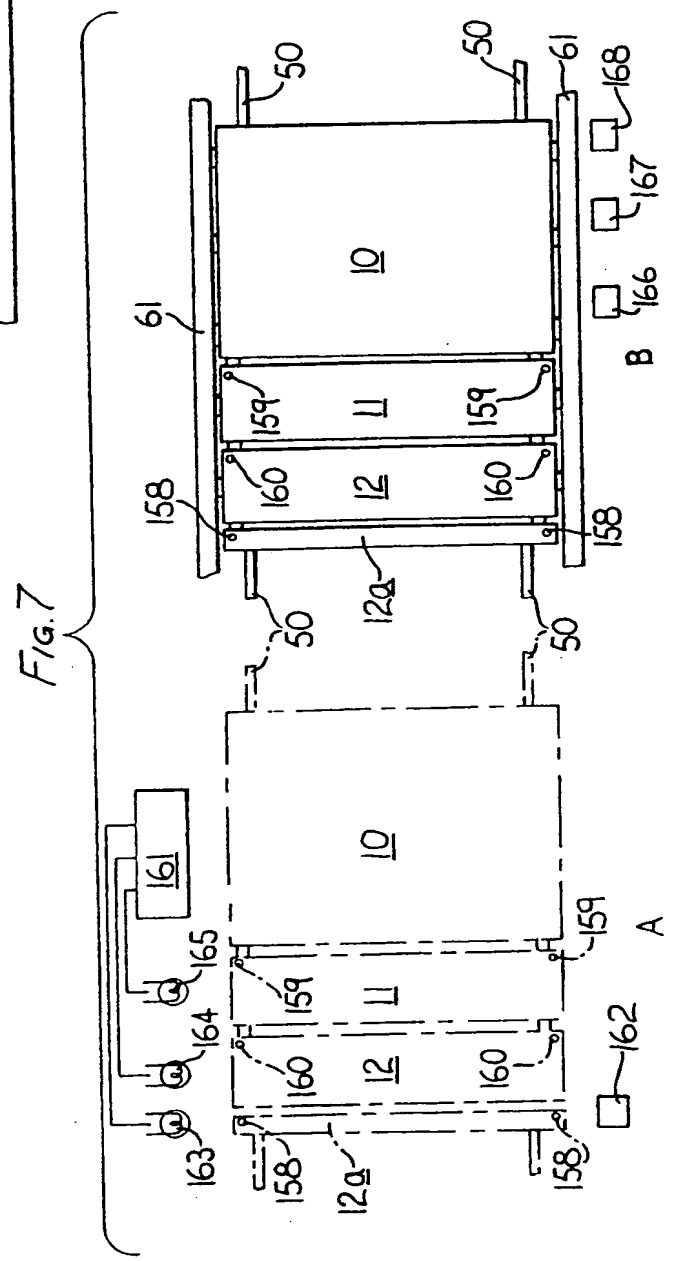

Fig.7

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SPECIFICATION

Sheet handling apparatus

This invention relates to sheet handling apparatus and more particularly to apparatus for forming sheets of paper or the like into stacks.

According to one embodiment of the present invention there is provided apparatus for stacking sheets of paper or the like including two stacking devices, means for feeding sheets to said stacking devices so that stacks are formed in each of said stacking devices alternately, and in which each of said stacking devices includes a platform on which said stacks are formed, said platform being constructed so that its length can be varied and comprising at least two sections, each of said sections having a pivotal connection to the next section.

It is common in machines for forming sheets of paper into stacks to provide a container, upstream of the stacking device, into which scrap sheets are fed, the sheets then being removed therefrom by hand.

According to a further embodiment of the invention there is provided apparatus for handling sheets of paper or the like comprising means for feeding sheets along a main path towards a stacking device, means for diverting said sheets along a secondary path, means positioned in said secondary path for cutting the diverted sheets into narrow strips and means for conveying said strips away from the apparatus.

The invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic side view of a machine for forming sheets of paper into stacks,

Figure 2 is a side elevation of a stacking device which forms part of the machine of Fig. 1, and drawn to a larger scale,

Figure 3 is a side elevation of a platform used in the apparatus of Fig. 2,

Figure 4 is a plan view of part of the device of Fig. 2,

Figure 5 is a side elevation of part of a modified form of platform shown in Fig. 3,

Figure 6 is a plan view of part of Fig. 5, and

Figure 7 is a diagrammatic plan view showing the different positions occupied by the platform of Fig. 5 when used in the stacking device of Fig. 2.

Referring first to Fig. 1, a paper web 201 is fed from a reel (not shown) by a pair of feed rollers 202. Prior to entering the nip of the rollers 202 the web 201 is slit longitudinally into a number of narrower webs by pairs of slitting knives 203, and downstream of the rollers 202 the web 201 is fed between a pair of rotating cutter drums 204 having knife blades which cooperate once every revolution of the cutter drums to cut a sheet from each of the slit webs.

From the cutter drums 204 the sheets are fed along a main path by a primary conveyor 205 comprising upper belts 206, 207 and lower belts 208, 209 and 210, the sheets being carried along by being gripped between adjacent runs of the upper and lower belts, which are supported on rollers as shown. The linear speed of the conveyor 205 is greater than the speed at which the sheets are fed to it from the cutter drums 204 so that the sheets become spaced apart from one another along the primary conveyor 205. The upper run of belt 208 is guided in a downward direction by a roller 211 and in a gap between this roller and the upstream end of belt 209 is a diverter 212 of any known type which is operated at certain times to deflect sheets from the main path to a secondary path. The sheets are fed along the latter by cooperating runs of the belt 208 and a belt 213. On emerging from the downstream end of the belts 208, 213 the sheets are cut into narrow strips by a fixed knife 214 and a four bladed rotating cutter 214a, the cut strips falling down a chute 215 on to a conveyor 216 which carries the strips away from the machine to a collecting station (not shown). Alternatively the sheets may be slit longitudinally into strips by a number of disc knives positioned across the width of the machine.

The upper run of belt 209 is guided in a downward direction by a roller 217 and a diverter 218 of any known type is positioned in the gap between the rollers 217 and the upstream end of belt 210. The diverter 218 is operated at certain times, as will be explained later, so that sheets are fed either by belts 207, 210 or by belt 209 and another belt 219.

Sheets which are fed by belts 207, 210, on emerging from the downstream end thereof, are fed on to a secondary conveyor 220 having respectively upper and lower belts 221, 222 which, in known manner, are driven so that their linear speed is slower than that of the primary conveyor 205 so that each sheet carried on the secondary conveyor 220 overlaps the preceding sheet by a predetermined distance. The overlapped stream of sheets thus formed is fed by conveyors 223, 224, 225 towards a stacking device 226 which forms the sheets into stacks as will be described later.

A second stacking device 227 is provided to which sheets are fed from the belts 209, 219, and another belt 228. On emerging from the downstream end of belts 219, 228 the sheets are fed on to a further secondary conveyor 229 having respectively upper and lower belts 230, 231 on which the sheets are overlapped in the same manner as those on the secondary conveyor 220, the overlapped stream of sheets being formed into stacks in

the second stacking device 227 which is similar to the stacking device 226.

In operation sheets are foemed into a stack in the stacking device 226 and when a desired number of sheets have passed through the diverter 218, the latter is operated so that sheets are then fed to the stacking device 227 until a desired number of sheets has passed the diverter 218, whereupon sheets are again fed to the stacking device 226. Whilst a stack is being formed in one of the stacking devices the completed stack is removed from the other stacking device.

Both the stacking devices 226, 227 are similar in construction so only the device 227 will be described but, where possible, the same reference numbers will be marked in the drawings on both stacking devices for the same parts.

Sheets are fed into the device 227 between rollers 2, each sheet leaving the rollers 2 travelling at a sufficient speed to continue in a substantially horizontal path to the right until it strikes a vertical face of a backboard 3; this stops the sheet which then falls.

Below the path of the successive sheets from the rollers 2 to the backboard 3, a stack 4 forms on a platform 1, to be described later, as each successive sheet falls on to the preceding sheet. The growing stack 4 is carried by the platform 1, which is lowered progressively at the same rate as that at which the height of the stack increases; this maintains a constant vertical spacing between the top of the stack 4 and the path of sheets from the belts 2 to the backboard 3, as is required.

The platform 1 comprises three sections 10, 11, 12, the right-hand section 10 is a long section and the sections 11, and 12 are equal in length to one another and each less than half the length of the section 1. The long platform section 10 is provided with two pairs of wheels 13 mounted under its end portions on axles 14, 15. The short platform section 11 is provided with a pair of wheels 16 under its end portion remote from the section 10 and similarly the short platform section 12 has a pair of wheels 18 under its end portion remote from the section 11, the wheels 16, 18 being respectively mounted on axles 17, 19.

Hinge connections are provided between adjacent sections of the platform, i.e. between section 10 and section 11 and section 12. The axles 15, 17 serve as pivot pins of the hinge connections. Each of the short platform sections 11, 12 has a respective extension 111, 121 to the right (as seen in Fig. 3) under the adjacent end portions of the sections 10, 11 respectively, these extensions being journalled on the axles 15, 17 respectively.

As shown in full line in Fig. 3, only the platform sections 10, 11 are supported (by means to be described later) in a horizontal position; the short section 12 therefore hangs vertically from its hinge connection, through axle 17, to the section 11. The length of the platform is thus equal to the combined length of sections 10, 11. If the section 12 were also supported horizontally, it would be in the position shown in broken line and the length of the platform would be equal to the combined length of all three sections. It is possible also to support only the long section 10 in the horizontal position, allowing both the short sections 11, 12 to hang vertically from the hinge connection through axle 15.

The sheets forming the stack 4 are longer than the platform section 10, but shorter than the combined length of the sections 10, and 11. As shown in Fig. 2, therefore, only the sections 10, 11 are supported in the horizontal position; the section 12 is hanging from its hinge connection to section 11. When the stack 4 is complete, feeding of sheets to the stacking device 227 is stopped and the platform 1 is lowered to the base 5 of the stacking device, where a pair of rails 50 are provided to receive the wheels 13, 16, 18. Upon reaching the rails 50, it is necessary for all sections of the platform 1 to be horizontal. To achieve this, positioned on each side of the platform when the latter is receiving sheets thereon, is a chain or cable 51 connected between an anchorage 52 and one end of a bar 71 pivotally attached, at its other end, to mechanism for raising and lowering the platform, to be described later. The two anchorages 52 are at a higher level than the rails 50 and the length of the chains or cables 51 is such, having regard to the position of the anchorages 52, that as the platform 1 is lowered, the chains or cables become taut before the platform has fully lowered and the bars 71 are swung about their respective pivotal attachments so that they both engage the section 12 and pull the latter into the horizontal position as lowering of the platform 1 is completed.

The platform 1 is raised and lowered by four chains 60 which are linked in pairs by two beams 61, only two of the chains being visible in Figs. 2 and 4. The beams 61 are disposed parallel to the rails 50 and are spaced apart by a distance slightly greater than the width (normal to the plane of Fig. 2) of the platform 1. The beams are longer than the overall length of the platform 1 (with all its sections horizontal) and project beyond the platform at each end, the chains 60 being disposed vertically and attached to the projecting ends of the beams so that all parts of the chains and beams are clear of the stack 4 during its formation on the platform.

The other ends of the bars 71 are respectively pivotally attached, at 72 (see Fig. 4), to a different one of the beams 61, the pivot 72 being aligned with one of the axles 15, 17 depending on the position of the platform 1.

Each beam 61 has five platform engaging lifting studs 62, 63, 64, 65 and 66 projecting horizontally from the beam so as to be engageable with blocks fixed to the underside of the platform (see also Fig. 4). The section 10 has two blocks 67, 68 fixed on each side thereof, the section 11 has one block 69 fixed on each side thereof and the section 12 has one block 70 fixed on each side thereof. Each of the stubs 62 to 66 is provided on its upper face with a conical projection 170 and to prevent any movement of the platform whilst the latter is being raised or lowered the conical projections 170 engage into respective mating recesses in the bottom faces of the blocks 67 to 70. When the platform 1 has its wheels on the rails 50 and all its length is between the beams 61, three stubs 62, 63, 64 from each beam project under the long platform section 10, one stub 65 from each beam under the short platform section 11, and the remaining stub 66 from each beam under the section 12. With the platform so positioned, lifting of the beams 61 by chains 60 causes stubs 62, 64, 65, 66 to engage blocks 67, 68, 69, 70 respectively and thus raises the platform 1 with all its sections horizontal, so that the whole platform is available to receive long sheets.

If medium-length sheets are to be stacked, i.e. sheets no longer than the combined length of platform sections 10 and 11, then the platform 1, when it is moved along the rails 50 from the left, is stopped when the blocks 67, 68 of the platform section 10 are respectively above the stubs 63, 65 of the two beams; the blocks 69 of section 11 are then above the stubs 66, no stubs are below the section 12, no part of the platform is above the stubs 62, and no blocks are above the stubs 64. With the platform so placed, when the beams 61 are lifted to raise the platform, the sections 10, 11 will be held horizontal to receive sheets, section 12 hanging (as in Figs. 2 and 3). For stacking short sheets, for which the platform section 10 is long enough it will be understood that the platform is stopped when the blocks 67, 68 of section 10 are respectively above stubs 64, 66 so that when the platform is raised both the section 11, 12 hang vertically as there are no stubs under them.

It will be appreciated that the use of the platform 1 as described above enables the backboard 3 to be moved to the left without difficulty when medium-length or short sheets are to be stacked, as the horizontal length of the platform 1 during stack formation will be less than its maximum length. This is particularly helpful when, as is common, an operator's position is associated with, and movable with, the backboard 3, as shown at 180 in Fig. 1.

If the stacking device is arranged so that the rollers 2 are movable to adjust the spacing between the rollers 2 and backboard 3, then the platform 1 may be used with the long section 10 at the left, the short sections 11, 12 at the right; the chain or cable 51 and its anchorage 52 will then also be at the right of the stacking device and the disposition of the stubs 62, 63, 64, 65, 66 on the beams 61 will be reversed.

To facilitate the movement of the platform 1 along the rails 50, when a completed stack of sheets is being removed and when the platform is moved into the stacking device, the platform is arranged to be self-propelled. The long platform section 10 carries on its underside a motor 73, arranged to drive the axle 15 and hence the wheels 13 on axle 15. Transmission of drive from motor 73 to axle 15 is effected by a gearbox 74 and a chain drive 75. In view of this the axle 15 necessarily extends across the width of the platform and has one of the wheels 13 secured to it adjacent to each of its ends. The axles 14, 16, 19 however need not extend across the width of the platform, and preferably are stub axles each carrying one wheel.

It is usual to form the stack of sheets on a pallet so that the completed stack may conveniently be handled by, for example, a fork lift truck. Referring now to Figs. 5 and 6, a modified form of platform 1 is shown with a pallet P of known form on its upper surface. As shown, all the sections 10, 11 and 12 will remain horizontal when the platform 1 is lifted by the beams 61. To enable the operator to place the pallet in the required position on the platform ready to receive sheets thereon as described above, he releasably fixes a gauge bar 150 across the platform.

For this purpose the platform 1 is provided with an additional section 12a comprising a U-shaped girder 151 lying on one side and carried on extensions 152 which extend under the adjacent end portion of section 12, the extensions being journalled on the axles 19 so as to form a hinge connection between the sections 12 and 12a. The section 12a also has a pair of wheels 153 positioned so that the upper face of the girder 151 is in alignment with the top of the sections 10, 11 and 12 when the platform is positioned on the rails 50.

The gauge bar 150 comprises a beam 154 provided near each end thereof with a vertical bolt 155 threaded at its lower end. Slidably mounted on the beam 154 are a number of settable markers 156 which may be clamped at desired positions along the beam by means of screws 157. Two threaded holes 158 are provided in the upper face of girder 151 (Fig. 7), and similar holes 159, 160 are provided respectively in the upper faces of platform sections 11 and 12.

The operator places the bar 150 on the section 12a and screws the bolts 155 into the holes 158, the right hand face of the beam

154 then forming a stop against which a pallet is placed. This positions the pallet correctly in the lengthwise direction to receive large sheets which require all sections 10, 11 and 12 to remain horizontal when the platform is lifted as described above. It often happens that a number of stacks are formed simultaneously side by side across the width of the platform 1. In such a case a separate pallet is placed on the platform to support each stack, and to ensure that the pallets are placed in the correct positions across the platform the markers 156 are first clamped in the required positions along the beam 154 to indicate the pallet positions. This is illustrated in Fig. 6 which shows two pallets P and P1. As the platform of Fig. 5 is lifted by the beams 61 the section 12a hinges downwardly about axles 19 so that it does not impede the flow of sheets as they are fed on to the platform.

If the sheet length is such that section 12 is not required to support the stack, the gauge bar 150 is placed on the section 12 and the bolts 155 screwed into holes 160; and if it is such that only section 10 is required to support the stack, the gauge bar is placed on to section 11 and bolts 155 screwed into holes 159.

As the lowering of a platform, as shown in Figs. 5 and 6, is completed the section 12a will be moved to the horizontal position by the bars 71 in the same way as the sections 11 and 12.

Referring now to Fig. 7 two positions A, B, indicating different positions occupied by a platform 1 during one cycle of operation of the stacking device are shown. Position A is the area where the platform 1 is prepared for receiving sheets by having one or more pallets placed on it, position B is the position in the stacking device from which the platform is lifted and to which it is returned by the beams 61 as described above

The motor 73 is most conveniently an electric motor and the platform may be provided with any conventional current pick-up devices for bringing an electric current supply to the motor. The energisation of the motor 73, and hence the movement of the platform along rails 50, may be controlled by the operator of the stacking device; in large measure however, such control may be automatic from a control device 161 which may, for example, be a micro-processor.

In operation, and assuming that platform 1 is in position B i.e. it carries a completed stack 4 and is wholly supported on the rails 50, the platform is moved along rails 50 to position A at which it is stopped when its presence is detected by a sensor 162. Whilst the platform is at position A the completed stack 4 is removed from the machine through one side thereof, and the operator fixes a gauge bar 150 into position, as described above. To indicate which platform section (i.e. 11, 12 or 12a) the bar 150 is to be fitted to, one of three lamps 163, 164, 165 is switched on by the control device 161 according to data fed into the latter (e.g. sheet length).

The platform is then moved to position B in the stacking device. The arrival of the platform at the desired position relative to the beams 61 is detected by one of three sensors 166, 167 and 168. The latter each correspond to one of the three positions at which the platform may be required to stop, according to whether the whole length of the platform (i.e. all three sections 10, 11 and 12) or only part of its length (i.e. sections 10 and 11 or section 10 alone) is to be supported horizontally during stack formation. The control device responds to whichever one of the sensors 166, 167, 168 corresponds to the length of sheets to be stacked. Upon completion of the stack and lowering of the platform the same sensor, or a further sensor, may detect when the platform is again supported by the rails 50 and may control energisation of motor 73 to propel the platform to position A. Although not shown, it will be understood that all the various sensors are connected to the control unit 161.

After the required number of sheets have been fed towards the stacking device 227 the diverter 228 is operated so that sheets are fed towards the stacking device 226 where they are formed into a stack in the same manner as just described in relation to stacking device 227. After the stack in stacking device 226 has been completed and the platform is wholly supported on the rails 50, at which time the platform is in position C, Fig. 1 (which corresponds to position B), the platform is then moved to position D (which corresponds to position A).

When the required number of sheets has been fed towards the stacking device 226 the diverter 218 is again operated so that sheets are again fed to the stacking device 227 and the sequence of operations described above is repeated.

There can be any number of sections making up the platform and in a further modified form the platform would be constructed in the manner of a roller shutter.

CLAIMS

1. Apparatus for stacking sheets of paper or the like including two stacking devices, means for feeding sheets to said stacking devices so that stacks are formed in each of said stacking devices alternately, and in which each of said stacking devices includes a platform on which said stacks are formed, said platform being constructed so that its length can be varied, and comprising at least two sections, each of said sections having a pivotal connection to the next section.

2. Apparatus for handling sheets of paper or the like comprising means for feeding sheets along a main path towards a stacking device, means for diverting said sheets along a secondary path, means positioned in said secondary path for cutting the diverted sheets into narrow strips and means for conveying said strips away from the apparatus.

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